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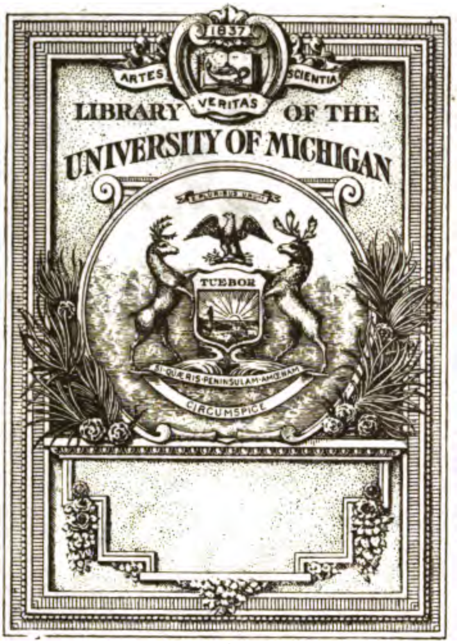
OF THE
COMMISSIONERS OF SHELL FISHERIES
1917



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State of Rhode Island and Providence Plantations

ANNUAL REPORT

OF THE

COMMISSIONERS OF SHELL FISHERIES

FOR THE

YEAR ENDING DECEMBER 31, 1917

AS MADE TO THE

GENERAL ASSEMBLY

AT ITS

JANUARY SESSION, 1918

PROVIDENCE:
E. L. FREEMAN COMPANY, PRINTERS
1918

COMMISSIONERS OF SHELL FISHERIES

AND THEIR DEPUTIES

1918

COMMISSIONERS OF SHELL FISHERIES

Edward Atchison .... P. O. Address, Slatersville, R. I.
William T. Lewis .... " " West Barrington, R. I.
Randall A. Harrington .... " " Warwick, R. I.
Milton Duckworth .... " " Carolina, R. I.
Henry K. Littlefield .... " " New Shoreham, R. I.

CLERK

Brayton A. Round .... P. O. Address, Providence, R. I.

ENGINEER

Walter W. Massie .... P. O. Address, Providence, R. I.

DEPUTY COMMISSIONERS OF SHELL FISHERIES

Oliver G. Hicks .... P. O. Address, Bristol Ferry, R. I.
Leman Wardsworth .... " " Wickford, R. I.
William B. Welden .... " " Providence, R. I.
John T. Smith .... " " Warren, R. I.
Israel A. Smith .... " " Pawtuxet, R. I.

BIOLOGIST AND BACTERIOLOGIST

Stephen DeM. Gage .... P. O. Address, Providence, R. I.

INSPECTOR OF OYSTER HOUSES

Seth Walton .... P. O. Address, Providence, R. I.

REPORT

To the Honorable General Assembly of the State of Rhode Island and Providence Plantations :

GENTLEMEN :—The undersigned, Commissioners of Shell Fisheries, as provided by law, herewith present for your consideration, a detailed statement of the receipts and disbursements and the doings and conditions of the department over which they have charge and jurisdiction. This report will contain, as required by law, the number of acres leased, with the names and addresses of the lessees, together with the amount of rental due from each, as of records, for the year ending December 31, 1917.

The personnel of the Commission remains the same as during the year 1916 with one exception; the Chairman of the Commission, Hon. Philip H. Wilbour, resigned as Commissioner of Shell Fisheries for Newport County in January, 1917, to accept, at your hands an election as State Auditor to succeed the late Hon. Charles C. Gray. Mr. Wilbour had served as Commissioner of Shell Fisheries for Newport County since 1898, and was chairman from 1900 to the time of his resignation. Mr. Wilbour's unerring good judgment, in the administration of the affairs of this department, as well as his unfailing kindness and courtesy to the members of the Board, and to all persons, who have had business to do and transact before or with the Commission, will be greatly missed, but we most sincerely trust that he will be as successful in his higher and more important position as he has been in the one from which he resigned.

The vacancy caused by the resignation of Mr. Wilbour was fille by your Honorable Body in Grand Committee on February 8, 191

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by the election of Hon. Henry K. Littlefield, of New Shoreham, as Commissioner of Shell Fisheries for Newport County.

We shall present for your consideration the different matters pertaining to the work of this department by subjects, making such recommendations as we deem advisable at the close of the discussion of the subject under consideration.

LAWS.

(CHAPTER 203) "Of Private and Several Oyster Fisheries."

This Chapter provides for the leasing of ground for the purpose of cultivation and propagation of oysters, and it has been on the statute for a great many years, in fact, the original act was passed by the Legislature in 1844, and the law of today is substantially the same as when it was first enacted. This law provides for the election of the Commissioners of Shell Fisheries by the General Assembly in Grand Committee. This Commission being one of the very few Commissions that are elected by your Honorable Body in Grand Committee. The early elections of this Commission usually took place in Newport and occurred at the spring session of the General Assembly, but upon the changing of the term of the Legislature so that there was no spring session, this chapter was amended so that the election should take place at the January Session every fifth year.

This chapter has been amended from time to time as the circumstances and necessities of the oyster business warranted such changes. At the January Session in 1917 there was an amendment to this chapter which added Section 36 and 37, which make provisions for the leasing of ground at one dollar per acre, per year, provided the same should be mud or soft bottom, so-called. As we have large areas of ground in Narragansett Bay that are suitable for cultivation of various specie of shell-fish that are not being utilized to their fullest capacity, being unsuitable for oyster culture, probably the best way to manage shell-fish culture, would be to let private enterprise develop this line of work and while it was being developed, to charge only a nominal rental for the ground used for such purpose.

This chapter provides for the exemption of a good many acres of ground that ought to be utilized for the production of some form of food, which is impossible to have undertaken, as the act now reads.

We are of the opinion that the time is opportune for a change in the provision of the leasing of the public domain for the cultivation of shell-fish. In fact, we are strongly of the opinion that the public domain should be leased for the cultivation of all species of shell-fish, and not for one only. This can be readily understood when one takes into consideration that we have one of the best areas for the cultivation and growth of shell-fish that exists on this continent, and that we are not utilizing it to its fullest capacity, simply because we are not letting private enterprise take up and develop many acres of our waste lands. We strongly recommend that there be a revision of this chapter and that the scope of the work provided for by this chapter be increased, to include all kinds of shell-fish culture.

(CHAPTER 1243) "Of the Protection of Quahaugs."

This is a comparatively new provision of the law, and it has given very satisfactory results, as it prohibits and prevents taking of small or seed quahaugs and shipping them into other states.

While the provisions of the chapter might appear to be somewhat burdensome, inasmuch as any person who is found with one quart of quahaugs less than one and one-half inches in diameter, taking the smallest diameter, shall be fined five dollars for each and every quart so found, nevertheless, it has proven very satisfactory and we strongly recommend that this chapter remain without amendment.

(CHAPTER 209) "Of the Scallop Fisheries."

This chapter is one that has given good satisfaction and has protected the scallops in a fairly satisfactory manner. We believe that there might be slight changes to this statute that would increase its efficiency, and that is, that the period of time which allows the fishermen to take scallops from the beds, which is at the present time from September 1 to January 1, might be changed to the advantage of the oystermen and to the advantage and welfare of the people of the State.

It is a pretty thoroughly and generally understood fact that during the month of September scallops increase in size nearly as much as in any two other months of the year, and that when the law allows them to be taken at the first of September, we are losing from one-third to one-half the growth of the scallops. During the month of September, not only do they grow rapidly but they harden up, and make a much more palatable food. We believe that the law should be shortened in the fall by about one month, as the seed scallop, if it has done well in growing, will have developed to that point which makes it a very great temptation to the fishermen, for during the month of December there is very little difference in size between the seed scallop and the old scallop, and as the price of scallops during that month is usually very high, many of the fishermen are apt to yield to the temptation of taking this young seed which destroys the next year's crop of scallops, as well as the set for the year to come.

We would recommend that this chapter be amended by shortening the season so that the scallop season will begin September 15 and close December 1, and that the quantity taken should not exceed twenty bushels per day, including the shells.

(CHAPTER 577) "Of the Protection of the Shell Fisheries in the Public Waters of the State."

This is one of the most important chapters that comes within our jurisdiction, as it pertains to the protection of the public health and provides that no oysters or other shell-fish shall be taken from beds which are not in proper sanitary condition for the production of shell-fish for consumption as food. This act provides that the Commissioners of Shell Fisheries may issue certificates for those beds which, upon examination, shall be in proper sanitary condition for such production. It also provides for the issuing of sanitary certificates for the opening or packing houses, where oysters are prepared for the trade. It also provides for the employment of an expert bacteriologist and chemist to conduct the experiments and researches necessary for the issuing of certificates. This statute was necessitated by the conditions that confronted the oyster industry in Rhode Island by reason of the discharge of manufacturing wastes and other matter, detrimental to the welfare of the oyster industry of the State, and it became necessary for the State to supervise and regulate the taking of shell-fish.

During the past year, we have had our sanitary work carried on by the State Board of Health with results that have been perfectly satisfactory.

There is one thing that may be said regarding this chapter, and that is, that just as long as the present sanitary conditions are allowed to exist in Rhode Island, just that long will it be necessary that supervision shall be made in the handling of the oyster industry. We would therefore recommend that this statute remain without change.

(CHAPTER 852) "An Act Regulating the Taking of Shell-Fish from Free and Common Fisheries."

This act was adopted by your Honorable Body at the January Session in 1912, and it provides for a closed season upon the taking of oysters from the public ground. It prohibits the taking of oysters northerly of Field's Point and Kettle Point from the first day of June in the one year to the first day of April in the following year. It also provides that no person shall take oysters from the free and common fisheries of the State between the fifteenth day of May to the fifteenth day of September of the same year. It also provides for the licensing of fishermen for the purpose of taking oysters, clams or quahaugs from the public fisheries, it also allows any person, an inhabitant of this State to take one bushel of oysters, clams or quahaugs from the public fisheries for his own use.

This law became necessary through the transgression and depredation committed by citizens of Massachusetts and Connecticut who made use of our shores and caught many hundreds of bushels of shell-fish, and carried the same out of the State, which would deprive the citizens of Rhode Island of just that much food. These depredations were committed mostly along the shores of Mount Hope Bay and Seaconnet River and particularly on the beaches of Tiverton, Portsmouth, Warren and Bristol. This law provides that no person unless he has been an inhabitant of the State one year, shall be allowed to take any shell-fish from the shore or waters of this State and it also provides that no person shall receive a license to take oysters, clams or quahaugs from the shores or the waters of the State, except he shall have been a resident of the State for one year prior to the date next preceding the date of application.

This act also prohibits the use of a dredge in the taking of oysters, clams or quahaugs from the public fisheries and allows only a dredge to be used under a provision of Chapter 209, to wit: Taking of scallops, and mussels. As to whether this last provision of the act is advisable or not may be questioned, for the reason that there are a good many acres of ground in deep water that contain oysters in sufficient quantity to make it profitable for many of the free fishermen to get them, and if this ground is in deep water, that is, too deep for them to be taken by means of tongs or rakes, they must necessarily be gathered, if at all, by a dredge, and it would seem as if it was not an economical way not to allow these shell-fish to be gathered and used. If they are not taken by the fishermen, they are destroyed by the starfish, and naturally where there is quite a large body of oysters, it forms not only a feeding ground but breeding ground for the stars; therefore, we question the advisability of prohibiting the use of a dredge upon the public ground by licensed fishermen.

We are inclined to believe that a properly prepared amendment to this chapter, which would allow the licensed fishermen to use dredges on the public ground and that will not only limit the quantity of shell-fish taken without a license, but also the use to which they may be put may be advantageous, and we would recommend that this matter be given consideration.

(CHAPTER 1602) "An Act for the Planting, Cultivating, Propagating and Developing of any and all kinds of Shell-Fish."

This is an act adopted by your Honorable Body at the January Session of the General Assembly, 1917. It gives to the Commissioners of Shell Fisheries authority to conduct experiments in the propagation and developing of any and all kinds of shell-fish. There has been a provision of the statutes like this for a good many years that allowed experimental work to be done by the Inland Commissioners of Fisheries, but the work undertaken by them was for experimental purposes only, and the scope of this act allows the Commission to extend the work to that degree that it may demonstrate the practibility of the cultivating and propagating of various species of shell-fish on a commercial scale.

We are inclined to believe that this act is advantageous, and that when the work shall have been taken up more extensively than what we did during the last season, we shall look forward to much good being accomplished. During the last season under the provisions of this act, we closed certain areas in the bay to the use of the public and allowed the sets of shell-fish thereon to grow and mature. We have found that this has been quite successful this year, and we are looking forward to more extended development of this line of work during the next season. We recommend that this act remain without change.

Summary of Shell-Fish Laws.

While we have called your attention to the different chapters of Public Laws pertaining to the work of this department, and have made some recommendations regarding some of its provisions, we are inclined to believe that there is one primary fault in the shell-fish laws:

First, we believe that the provision of the law that has restricted the leasing of ground for the cultivating and propagating of oysters only, has been erroneous for the reason that it has allowed us to utilize only small portions of the area suitable for the cultivation of food, whereas, there might have been a much more extended industry developed, and it has also allowed only one species of shell-fish to be grown and thus limited the opportunity of the grower, whereas, if the law permitted the leasing of ground for the cultivating of all species of shell-fish, we could have let many acres of ground for the cultivation of other species of shell-fish and not only have builded, developed and increased the fishing industry, but have produced a much more extensive and larger quantity of food for the use of the people. We believe that it is a short-sighted and rather arbitrary provision of the law that does not allow the use of the public domain to be developed to its fullest capacity.

Second, we are inclined to believe that the penalty that is attached to the various sections of the shell-fish laws for the infraction or breaking of the same, is too small and inadequate, for the reason that it is exceedingly difficult to secure evidence to warrant prosecution, and not only is it difficult, but it is very expensive, in fact, most of the cases which we have had under consideration and carried through, have cost, to secure the evidence necessary to bring a suit, from two to five times the penalties provided in the section violated. We believe that a careful revision of the penalties provided in this section should be undertaken and fines provided that would reimburse the State to some extent for the expense incurred in securing the conviction.

Third, we also have found that there is a lack of coördination in the various passages of the shell-fish laws, in that, some of the chapters provide for the searching, without warrant, in places where violations are suspected to have taken place, while other passages do not make any provisions whatever. We believe that this should be eliminated by a general provision of the law, that would allow the Commissioners of Shell Fisheries and their duly appointed Deputies to go into and search any place other than a dwelling house, where they have reasons to believe there has been violations of the shell-fish laws.

We will at the present session of the General Assembly present an act along the lines which we have suggested in this discussion, and ask that you give the subject careful consideration.

GROUND EXEMPT BY LAW.

There has been established, by law, in Rhode Island certain lines which are known as exemption lines, inside of which no ground may be leased. While the establishing of exemption lines may have been a wise procedure at the time they were adopted, it would seem to us, that they had outgrown their usefulness, in fact, that they materially retarded the advancement of the oyster industry, for the reason that some of these exempted grounds are valuable shell-fish ground, which should be utilized and not allowed to go to waste, as now is the case.

We would recommend that the matter of exemption of oyster ground be taken under consideration and a readjustment of the exemption lines adopted.

PUBLIC GROUND.

There are, in Narragansett Bay, more than 75,000 acres of ground which are not being used in the cultivation or propagation of any form of shell-fish whatever. Some of this area is particularly well adapted to the growing of the various species of shell-fish that inhabit our bay.

No doubt there is very little public ground that is not under lease, that is suited for the cultivation of oysters, but while that is the case, there are many acres of ground that are suitable for the growing of the other species of shell-fish. We have a very good illustration of this in a report made to us by Dr. Irving Field of the U. S. Bureau of Fisheries, who has conducted a series of investigations this past season, to ascertain the available and suitable acreage for the cultivtion of mussels. He has ascertained that there are more than 1,100 acres of excellent mussel beds in Rhode Island, and while they are not being utilized at all, except by the people who desire to catch mussels for bait, nevertheless the mussel is a rich and nutritious shell-fish and ranks in many places next to the oyster in importance. While this information has been furnished to us regarding the mussels, we believe there are extensive areas of public ground that are well adapted to the cultivation of quahaugs, which everyone knows is an important shell-fish, and we also believe that there is quite a large area of ground suitable for the planting and cultivating of clams, which are one of the shell-fish that have no protection under any of our existing laws, and neither are they cultivated in Rhode Island. There is also quite a large area of ground that is suitable for the cultivation of scallops, which, it would seem to us, might be profitably undertaken.

It would seem to us that as the oyster industry in Rhode Island is rapidly diminishing, it would be a wise procedure for the State to take some measures that would encourage and built up a shell-fish industry and not an oyster industry alone. We believe that it is not good judgment to allow the vast public area situated in Rhode Island to lie dormant, particularly as this area could grow food for the people of, not only Rhode Island, but the surrounding country. At a time like what now confronts us, we feel that there should be put forth an extraordinary effort to cultivate the ground to its fullest capacity, making it produce as much food as possible for the consumption of the people, in fact we feel that the production of food at this time, is the most important subject that we can present for your consideration, and we earnestly urge and recommend that you amend the shell-fish laws so that this vast area, which we are discussing, may be utilized to its fullest capacity.

OYSTER INDUSTRY.

Again we have to report that the oyster industry in Rhode Island is diminishing and diminishing very rapidly. While this industry in Rhode Island is one of the leading shell-fish industries in the country, we are afraid that unless some measures are taken to give it encouragement it will cease to occupy that position.

While the cultivation of oysters in Rhode Island has been conducted for a good many years, in fact, for more than a century, it has been only within the past fifteen or twenty years that it has reached a point of considerable importance, and we believe it could have retained its prominence and importance, if it were not for the condition that confronts us in Rhode Island, to which your attention has been repeatedly called; and that is, the pollution of the waters of our upper bay and the destructiveness of the starfish in our lower bay. It is primarily due to these two factors that we are compelled to announce the continued decreasing of the oyster industry.

The rapid progress of our industry in 1905, 1906, 1907 and 1908 is chiefly due to the fact that in those years there was phenomenal oyster set obtained in Rhode Island, and the oystermen taking advantage of the conditions at that time, used large areas of ground which really were not suitable for oyster cultivation, but almost any ground that was hard enough to hold up oyster shells would be almost sure to obtain a set and therefore, this area of ground was rapidly taken by the oystermen, but during the past four years, they have obtained very little oyster sets in Rhode Island, and as these sets of oysters in the years mentioned, have matured and have been used, the grounds have become vacated, and not obtaining any oyster sets on the same, the oystermen have felt obliged to relinquish them.

While there has been, as previously stated, small sets of oysters during the last four years, many of the sets have been destroyed by the starfish, and what with the inability to obtain sets, and the destructiveness of the starfish, the oystermen have had much difficulty in obtaining stock for their trade, and they therefore, almost invariably have decreased their holdings extensively.

There is a condition that has developed in Narragansett Bay which is unexplainable, and that is, ground that a few years ago was capable of and did produce excellent oysters, now at this time, does not produce oysters that are hardly suitable for market. It is a well known fact, that some of these beds that produced oysters a few years ago that would open four quarts or better to the bushel, now produce two quarts or less per bushel, and also an inferior grade compared to what formerly was produced. Why this change in conditions, we are unable to explain, and we have not found anyone who is able to explain the same, although it has been fully demonstrated as being a fact.

There is another condition in Rhode Island that is unexplainable and also different from former conditions, and that is, discoloration of oysters. One of the reasons why the oyster industry progressed rapidly and why many of the Connecticut people came here and took out ground was, that the oysters of Connecticut being grown in deep salt water were discolored, having a green color and they found if they planted the oysters in Narragansett Bay, the color would be removed, and they would be improved in quality. But we are sorry to announce that many of our oyster beds in Rhode Island today, produce green oysters which are identical with those produced in Connecticut, and some of the ground has been cancelled because of this fact, that the oysters did not improve and whiten out and become suitable for market.

There has also developed in Rhode Island, to some extent, another factor that has discouraged and injured the oyster industry, and that is, red oysters. This is something that has recently occurred in Rhode Island, although in certain sections in Connecticut, for several years, they have had red oysters, but we have escaped until within the past season. There are certain locations where the oysters, early in the season seem to contain some organism, that after the oyster has been opened and placed in containers for a short time, develops and discolors the oyster, but neither the green or the red is injurious to the public health.

We believe that in order for the oyster industry in Rhode Island to regain some of its previous importance, some of these problems should be taken under consideration, and investigations conducted to ascertain, if possible, the cause of these conditions. No doubt if the cause of this condition could be ascertained, there could be some remedy found which would again make the oyster industry important. We believe that some investigations should be undertaken by the Board, looking forward to a building up of this industry.

SANITATION.

The sanitary growing and handling of shell-fish is one that has received considerable attention from almost all of the states, and also much attention from the Federal Government. The rapid growth of the municipalities situated on many of our bays and estuaries, where shell-fish are naturally grown, has necessitated a supervision of this work.

In 1910 our attention was called by the U. S. Bureau of Chemistry to the conditions in Rhode Island, that were unsatisfactory and the matter was taken up by the Commission, and a series of examinations made, extending from 1910 to the fall of 1915, and the results of these investigations were tabulated, with the result that it was deemed advisable to change our system of work, and we consulted with the Bureau of Chemistry regarding making changes, and upon their sending to us representatives the matter was taken into consideration and our recommendations were accepted by the Government, with the result that we established sanitary zones in Rhode Island. By changing our form of work, and establishing these zones, we have been able to take care of the sanitary situation in Rhode Island satisfactorily. This consists of examinations of beds in Zone No. 2, and the issuing of certificates upon such examinations, while the oyster beds situated in Zone No. 1 have certificates issued without examination. While, as we have said, this takes care of the situation fairly well, it does not eliminate the source of the trouble in any way whatever.

While there is no question but that there has been some improvement in the sanitary condition in the waters of Narragansett Bay, this improvement is not as great as it should be. It would seem to us that there ought to be some change in the sanitary conditions surrounding the tide waters of Narragansett Bay, not only on account of the oyster industry as a source of revenue to the State, which really is secondary, but because of the fact, that we are allowing to be destroyed for food purposes, a large territory of exceedingly valuable land. We believe that it is an unwarranted waste of one of nature's most valuable resources. We feel that if this matter is not taken under consideration and some means provided for a different system of disposing of sanitary and manufacturing wastes, the fishing industry of Rhode Island will ultimately be completely destroyed, and one of the most valuable bodies of water in this country will thus be made useless as a food producing medium.

We know that so long as the conditions that confront us in Rhode Island are allowed to exist, there will have to be a considerable amount of sanitary supervision, and we believe that while this sanitary supervision is being undertaken there should be also at the same time and with the same force quite a large amount of biological research work undertaken. There is no question whatever in our minds but what there ought to be biological research work undertaken by the State, for as we have previously mentioned in another paragraph, the conditions that confront us in Rhode Island are such, that unless there is some means adopted whereby we can change conditions, we are going to lose more of our acreage and further decrease, not only the revenue, but the quantity of food produced. Now in order that this work might be advantageously undertaken it seems to us that there ought to be established a shell-fish experiment station, where not only could some of our sanitary work be taken care of, but a reconstructive and biological research work carried on. Now a shell-fish experiment station, in order that it be of value, should be situated on the bay where the waters are pure and where the work could be undertaken under conditions that are as nearly natural as possible. The fact is, that certain experiments are conducted successfully in a laboratory and results obtained which are quite satisfactory, but when those experiments are undertaken on an extensive or commercial scale, the results are entirely unsatisfactory, therefore in order to have work performed that will be of value, the work should be undertaken on at least a medium or small commercial scale, and then the results obtained may be assumed as being what can be obtained by the oystermen along those same lines.

If we had such an experiment station, there is no doubt we could receive material assistance from the U. S. Government, as the different bureaus will undertake various phases of both sanitary and constructive shell-fish work.

The past season the U. S. Public Health Service has had in Narragansett Bay a corps of men who have been conducting a series of sanitary investigations and we have rendered to this corps of Government Experts such assistance as we were able, and have furnished them with the information obtained by us during the past five or six years' work, which they informed us has given them much assistance.

We have, this year, had what sanitary work as was necessary to be undertaken, performed by the Board of Health. In the previous years, the work had been performed by Prof. Gorham of Brown University, but this year, owing to the condition that confronts us, we felt that perhaps the work could be performed by the Board of Health, as advantageously as heretofore, and accordingly we have had the work performed by them, and a report is herewith included.

REPORT OF THE CHEMIST AND SANITARY ENGINEER OF THE STATE BOARD OF HEALTH.

Commissioners of Shell Fisheries.

Gentlemen :—I present herewith a report on sanitary examinations of oyster beds during the year 1917.

During the present year, by a coöperative arrangement with the State Board of Health, the examinations of samples of oysters and the investigations necessary for the sanitary control of oyster beds, which in previous years have been made by Professor Gorham of Brown University and his assistants, have been made under my direction by the staff of the State Board of Health. Under this arrangement, the State Board of Health has permitted the use of its laboratories and equipment and authorized its scientific staff to perform this work, while your Board has furnished such extra apparatus and materials as were needed and have paid for the actual time of employees of the State Board of Health while engaged in shell-fish investigations.

As this coöperative agreement was not made until after the oyster season was opened, at which time many applications for examinations and certification were already on file, it has seemed advisable to limit the sanitary work for the year to that necessary for the purpose of issuing sanitary certificates. In this respect we have been greatly helped by a new method of grouping the oyster grounds into sanitary zones, and by the fact that the oysters in many of these zones have cleared up somewhat earlier than usual, and that repeated examinations of these grounds have therefore been unnecessary. In all, the work has included the examination of 75 samples of oysters from 50 different oyster beds.

During the past summer a field party from the U. S. Public Health Service has been engaged upon a general sanitary survey of the waters of Narragansett Bay. Through close coöperation with these gentlemen, not only have we been enabled to assist them in their investigation, but have had the advantage of their experience in similar studies elsewhere, and of the results of their investigation as it progressed, which have been of great assistance in planning and carrying out our own work for the year.

Classification of Oyster Grounds into Sanitary Zones.

In 1916, with the approval of the U. S. Bureau of Chemistry, your Board made a change in the method of issuing sanitary certificates, and divided all usable oyster grounds into two classes or zones.

In one class (Zone II) were included all grounds which the results of examinations during the previous years had shown to be of proper sanitary condition throughout the entire oyster season. Certificates for taking oysters from such areas are granted without sanitary examination.

In the other class (Zone I) are included those areas which previous experience had shown would be in proper sanitary condition after the beginning of cold weather, but upon which there was more or less question as to whether oysters from them would be suitable for use during the first three months of the oyster season. Certificates for the use of beds in this class are issued December 1, and upon request, may be issued earlier in the season, provided the results of sanitary examinations are satisfactory. By this system, the routine examination of oyster grounds which experience had shown to be of good sanitary quality throughout the entire oyster season was eliminated, and the sanitary work was concentrated upon the grounds of questionable character.

During the present year, for convenience, we have further grouped the oyster grounds of questionable character into sub-zones or areas with natural geographical boundaries. In making examinations within these sub-zones, we have endeavored to obtain samples not only from beds for which certificates have been requested, but also from such other beds as were necessary to give us a representative idea of the sanitary condition at that time of all beds within this area. This plan has also been followed in general in issuing sanitary certificates, no certificates being issued for any bed in a certain zone until all beds in that zone could be certified.

By this plan all lessees or owners of oyster grounds in a given territory receive their sanitary certificates at the same time, and the condition where one oyster man might be permitted to use his grounds while another owning adjacent ground could not use the oysters thereon, has been very largely eliminated. I understand that this plan has met the hearty approval of the majority of the oyster growers, and that they feel that it is much fairer to all parties concerned than the indiscriminate examination and certification of individual beds.

The results of our examinations and a study of results obtained in previous years indicate that certain oyster grounds between Rocky Point and Conimicut which are now included in the zone for which certificates are issued without examination (Zone II) should rightfully be grouped with other beds somewhat further north upon which a satisfactory examination is required before certification. The investigations by the U. S. Public Health Service show that the influence of the flow of a single tide from Providence may be observed as far south as Rocky Point, and this effect should be taken into consideration in establishing the line of demarcation between these two zones. After consultation with Mr. Round of your department, and with Dr. Carmelia of the U. S. Public Health Service, I would recommend that in granting certificates for next year, the demarcation between zones I and II be established at a line running due east from the triangulation station at Rocky Point.

METHODS OF ANALYSIS.

As in previous years each sample collected has consisted of fifteen or more oysters. The methods employed in the laboratory have conformed closely to the Standard Methods of the Laboratory Section of the American Public Health Association with certain minor variations in technic which experience had showed would reduce the amount of time consumed in the analysis or would increase the accuracy of the results.

These various methods have been essentially the same as those employed by the U. S. Public Health Service, and it is gratifying to note that the results obtained in the two laboratories under similar conditions are in close agreement. Throughout the work we have also attempted to keep a careful record of the conditions of wind and tide and of the temperature and salinity of the water at the time the various samples were collected, in the hope that these data, while perhaps of relatively small significance at the time, might yield valuable information when compared with similar data in the future.

FURTHER INVESTIGATIONS NEEDED.

A study of the results obtained during the past few years shows that we have yet much to learn about the sanitary condition of the oyster beds in certain localities in Narragansett Bay. This is particularly true in connection with the grounds in the vicinity of Conimicut Point and also those at the mouth of the Kickemuit River. In many instances, oysters from these areas have been found to be of excellent sanitary quality, while samples collected later in the season have been found to be of very questionable quality.

These irregularities have in a certain measure been explained by the valuable investigations of the U. S. Public Health Service during the past summer, but a considerable amount of supplementary work is necessary to confirm and complete the results which they have obtained. Further concentrated investigations of the effect of winds and currents upon the carriage of sewage matters from Providence, Bristol, Warren, Fall River and Newport to our various oyster growing areas are particularly needed, and such studies should include both wind and current measurements and sanitary analyses of water and oyster samples under a variety of conditions.

Recent experiments by the U. S. Bureau of Fisheries have indicated that by the application of certain purification methods, it may be possible to so treat oysters and other shell-fish from badly polluted areas that they may be safely used for food. As the taking of oysters for food from certain Rhode Island waters is now prohibited, on account of excessive pollution, and as the amount of pollution entering the bay is continually increasing, a thorough investigation of these new purification methods should be made as soon as possible.

SHELL-FISH EXPERIMENT STATION.

In the report of your bacteriologist for 1916, attention was called to the need of an experiment station for the study of the many special problems which affect the shell-fish industry in the State. At the present time, when there is urgent need for the conservation of all available sources of food supply, every possible means should be taken not only to make all our shell-fish bearing areas more productive, but also to increase these areas to the greatest possible extent, and in this respect there is no question but that a shell-fish experiment station would be of inestimable value.

SANITARY CONTROL OF OTHER SHELL-FISH.

For some years, the State through its Shell-fish Commissioners, has attempted to control the sanitary quality of oysters gathered for food. I wish at this time to emphasize the necessity of the extension of this sanitary control to other shell-fish and particularly to quahaugs.

The greatest consumption of quahaugs and clams is during the off season for oysters, that is during the summer, when according to all available evidence sanitary conditions are their worst. Soft clams, although used in very large numbers at this season of the year, are usually cooked before being eaten and the danger of the transmission of disease through their means is thereby largely eliminated. Quahaugs, especially "little necks," however, are eaten raw in large quantities, and the necessity for sanitary control over the quahaug industry is fully as great as is the necessity for the control now exercised over the oyster industry. Furthermore, as soft clams thrive vigorously in the vicinity of sewer outlets, it would seem that common decency and cleanliness require that the consumer be safeguarded against the sale of clams, which, while after cooking are perhaps not dangerous to the health, may be in an extremely filthy condition.

Respectfully submitted,

STEPHEN DeM. GAGE,

Chemist and Sanitary Engineer.

METROPOLITAN SEWAGE COMMISSION.

We are firmly of the opinion that the most practical and complete plan whereby the waters of the bay and its tributaries may be freed from sewage contamination and the contamination of manufacturing plant wastes is by the establishing of a Metropolitan Board or Commission. This proposition of establishing of a Sewage Commission is much more important than what it appears from a casual consideration of the subject. If you consider for a moment that there are over 400,000 people situated in close proximity to the headwaters of Narragansett Bay, with enormous manufacturing plants established on both sides of the bay and tributaries, that discharge the waste materials into the river, you must understand that the contamination is very great, and that the longer the contamination continues, the worse the condition will be found to be in the river. There is no question in our mind but what if this area beneath the waters of the bay and river should be conserved for the production of food, there must be some way to eliminate this condition, and as we previously said, we believe that the most thorough, practical and complete plan for its elimination will be in the establishment of a State Sewage Board or Commission.

Not only are the waste materials from the city of Providence, Cranston, Pawtucket, Central Falls, and East Providence discharged into the bay, but much of this discharge is absolutely untreated, and the quantity of material discharged into our bay that is injurious to fish is probably in excess of 20,000,000 gallons per day.

At a previous session of the Legislature, Senator Edwin C. Pierce introduced an act creating a Metropolitan Sewage Board or Commission. At a hearing given by the Committee on Judiciary of the Senate, there was very little opposition against his bill and we are of the opinion that there ought to be a resolution adopted by the Legislature which will authorize the Governor to appoint a committee to investigate this entire subject; this committee should have full authority and should also be provided with an appropriation necessary for them to give this a thorough examination and secure the advice and assistance of experts. We feel that this committee should be given instruction to report back to the Legislature their findings and recommendations, with a complete act provided for the carrying out of the recommendations contained therein. We earnestly urge that your Honorable Body give this matter very careful and thorough consideration and we recommend that a resolution be adopted as herein set forth.

INSPECTION OF OYSTER HOUSES.

The chapter of the Public Laws that provides for the sanitary examination of oyster beds and for certificates of the same as to their condition, also provides that the oyster or opening houses shall be inspected and no person shall open or shuck oysters in any house that is not certified as to its sanitary condition and the methods used in such work. Therefore, we have employed an inspector for this work, and his duties are to make numerous visits and inspections to the various oyster houses and to observe the methods used by the oystermen, the condition in which they keep their houses and the apparatus used by them, the time allowed for washing and cooling oysters and the methods of refrigeration. We have arranged a scoring system modelled after the methods of handling milk, and we have found that this scoring and the card indexes have proven very satisfactory, as it gives equal consideration, without regard to size of plant or quantity of product produced.

The gentleman having this work in charge gives thorough and close attention to this work, having made 86 visits from September 1 to December 31, 1917.

You can readily see by following this work as closely as we do, we are at all times in touch with conditions and are thus able to guarantee a perfectly sanitary, clean and wholesome product being distributed to the people from the oystermen.

MEETING OF THE NATIONAL ASSOCIATION OF FISHERIES COMMISSIONERS, HELD IN PROVIDENCE.

The ninth annual convention of the National Association of Fisheries Commissioners was held at the Crown Hotel in the city of Providence, June 7, 8, and 9th, and it was the guest of the Inland Fisheries Commissioners and the Commissioners of Shell Fisheries. The Vice-President of the Association, Mr. Brayton A. Round, presided over the opening exercises, and on behalf of the Commissioners of Shell Fisheries and the Inland Fisheries Commissioners extended a cordial welcome to the delegates and guests of the convention.

His Excellency, Governor Beeckman, was to have addressed the convention, but having been called to Washington, a letter expressing his regret at not being able to be present, and extending a warm welcome to the members of the association was read by the Acting President, after which His Honor, Mayor Gainer of the city of Providence, was introduced, and he extended a hearty greeting to the members of the convention, and he extended to them the hospitality of the city. This address of welcome by His Honor, the Mayor, was responded to by M. L. Alexander of Louisiana, Ex-President of the Association and Chairman of Conservation Commission, who expressed the appreciation of the convention to the welcome extended by the Governor and His Honor, the Mayor of Providence, in a few well-chosen words.

The afternoon session was called at 2:00 o'clock, at which time the President of the Association, Mr. Swepson Earle of Baltimore presented the annual address of the President and also read a telegram of regret from the Secretary of Commerce, William C. Redfield, telling of his inability to be present and particiate in the exercises of the convention. At the conclusion of the President's address, Hon. William H. Killian, President of Oyster Growers' and Dealers' Association of North America, and member of Conservation Commission of Maryland presented an address on "Coöperation of the several State Commissions. This interesting address was followed by discussions by Charles S. Arnow, State Game and Fish Commissioner of Georgia; William C. Adams, Chairman of the Fish and Game Commission of Massachusetts; Horace E. Kelsey, Chairman of Shell-Fish Commission, Connecticut; and H. L. Gibbs, Commissioner of Fisheries of North Carolina.

Following Mr. Killian's address, one was presented by Mr. W. H. Raye, President of the North Atlantic Oyster Farms Company, upon "Commercial Shell-Fish Industry." Mr. Raye's paper was discussed by Mr. A. S. Higgins of the R. R. Higgins Company of Boston and also by Mr. Alexander of New Orleans, Mr. Graham, Mr. Killian, Mr. Arnold also participated in the discussion of this paper.

Dr. Irving A. Field of Clark College, Worcester, Mass., delivered an illustrated lecture on "Unutilized Marine Food Resources, with special Reference to the Sea Mussel," on the evening of June 7th, at 8 o'clock.

On the morning of June 8th, a paper on "Lobster Culture" was presented by Mr. Ernest W. Barnes, Superintendent Inland Fish Commission of Rhode Island. The discussion of Mr. Barnes' paper was led by Prof. D. L. Belding, Biologist, Fish and Game Commission of Massachusetts, and was followed by Daniel B. Fearing, President of Inland Fish Commission of Rhode Island, and Mr. O. H. Dunbar, Commissioner of Sea and Shore Fisheries of Maine. Following this paper, was an address by Mr. John S. Parsons, Commissioner of Fisheries of Virginia, on "Virginia's Opportunity to Increase Nation's Food Supply." The discussion of this address was participated in by Mr. W. Thomas Kempt, Chairman of Conservation Commission of Maryland, and Dr. Joseph Hyde Pratt, Geologist of North Carolina.

Following this paper, Prof. Gorham of Brown University, gave an address on the general subject of "Sanitation." The discussion of his address was participated in by Dr. Wm. F. Wells, of the U. S.

Bureau of Fisheries, Stephen DeM. Gage, Rhode Island Board of Health, Dr. Lester A. Round, U. S. Bureau of Chemistry, Washington, D. C.

At the evening session on June 8th, John W. Titcomb, Fish Culturist of New York, delivered an illustrated address on "Restocking Depleted Ponds and Rivers," which was listened to with close attention and was followed by a general discussion.

On Saturday morning the U. S. Public Health boat, "Murray," lent by the courtesy of the U. S. Public Health Board, took a party to Wickford to inspect the lobster hatchery, returning from Wickford, they stopped at Rocky Point and had an old-fashioned clam bake.

OYSTERS.

Oysters are one of the species of shell-fish that have been used as food for hundreds and probably thousands of years, and they have been cultivated more than all other shell-fish combined, in fact, it was the only shell-fish to receive any attention from the point of cultivation for a great many years. It is the only shell-fish that is cultivated by private enterprise in Rhode Island, although we know no reason why other shell-fish should not be cultivated along the same lines that oyster cultivation is conducted. Oysters are one of the shell-fish that have probably more enemies than any other species of shell-fish. It is more difficult to successfully cultivate oysters than quahaugs or clams, but not withstanding this difficulty, there have been a good many thousands of dollars spent in their propagation and cultivation. Oysters are destroyed in large quantities by means of drum fish, starfish and other enemies, that is, the different animals that subsist on oysters being peculiar to various locations where oysters are grown. The drums in the south destroy a good many oysters and are one of the oystermen's sources of trouble. While in Rhode Island, the starfish is the chief enemy of the oyster, and whatever is the chief enemy of the oystermen, is also the enemy of food, for they not only destroy the oysters, and thus decrease the earning capacity of the oystermen, but they destroy a large quantity of food. The extermination of the stars by the oystermen is a difficult and expensive procedure.

There are very few young oyster sets in Rhode Island at this time, as the oystermen have used up the sets and seed of the prosperous years preceding the last three or four, and the oysters that are now used, are brought from Connecticut, Massachusetts or from the Chesapeake Bay, and the indications are that next year the oystermen will have to continue the same procedure, unless by some fortunate circumstance they are able to obtain a set, for during the past four years they have obtained but little oyster sets and the season of 1917 was no exception to the previous three or four seasons, in fact, there were probably less sets obtained than in any previous year during the past fifteen years.

QUAHAUGS.

Quahaugs are one of the species of shell-fish that in our opinion can be produced to advantage on the vast areas of ground that are not suitable for the cultivation of oysters. We see no reason why quahaug cultivation could not be as successfully practiced as oyster cultivation, in fact, we are of the opinion that it would be equally as successful as the oyster business, if encouragement were given to those who are willing to undertake the experiment. There is one advantage that quahaug cultivation would have over the oyster cultivation, and that is, that the enemies of the quahaugs are not nearly as great as those of the oysters, and that this product finds a ready market at good prices, and could be produced and marketed for a less overhead charge than the oysters.

In the case of the oyster business, it is necessary for the oystermen to prepare his oysters for market by opening in shucking houses, washing and cooling to prepare for the containers and at which time they must be iced suitably to protect from spoiling, while the quahaugs would not have to be opened or shucked and could be shipped in barrels, boxes or sacks without being iced to any extent except in the warmest weather. Then again the oyster business is confined principally to about five months of the year, while quahaugs may be handled during the full twelve months of the year, and especially during the summer months when the oyster business is at a standstill. We believe that quahaug culture should be encouraged in Rhode Island and that ground should be leased for that purpose. We have leased 240 acres of ground situated in Sakonnet River for a short term of years for the express purpose of having the experiment carried out to ascertain if quahaug culture may be successfully developed. We certainly trust that the experiments undertaken will be successful and that the Commissioners will be given every authority to develop this industry to its fullest capacity. There has been one of the most expensive and best sets developed in this past year that has been in many years.

CLAMS.

Soft-shelled clams (so-called) are one of the shell-fish which have no protection under the laws of the State of Rhode Island and while there is an abundance of clams in Providence River, there is no protection whatever, excepting such as is given by the Commissioners of Shell Fisheries closing areas to the use of the public and thus allowing the small sets of clams to grow and mature. While this is being done at this time in two or three places in Rhode Island, the other shores are being depleted of the clams. We are strongly of the opinion that clam cultivation should be undertaken in Rhode Island, the same as in Massachusetts and Maine. We believe that it is for the best interests of the citizens of the State of Rhode Island to allow clam grounds to be leased for private culture and development. It has been found in Maine that by leasing one-quarter of the available clam flats they have been able to produce, on the three-quarters remaining, more clams than were produced on all the ground, before the one-quarter was leased. Now you can readily see that if one-quarter of the clam flats were leased to private enterprise, we believe that we would be as successful here, as in Maine, and we see no reason why there should not be more clams for the people, who desire to go upon the shores and gather them, than there is now upon the entire area. At the same time the lessee and grower of clams would produce a considerable quantity of clams for the people who are so situated as to be unable to gather them for themselves, and at the same time the price of clams would be reduced. We believe that it is for the best interests of the people of Rhode Island to allow at least one-quarter of the available acreage for clam culture to be leased and an industry of this nature encouraged.

SCALLOPS.

The scallop fisheries of Rhode Island during the past season have not been very productive, but the outlook for the coming summer is exceedingly good. A little over a year ago, we planted scallops in various sections of the bay, taking from Cowesset and with the results that this year there is one of the most extensive and widely distributed scallop sets that there has been in Rhode Island for the past thirty years, and unless the severity of the winter destroys them, the outlook for next year is exceedingly good.

We believe that these shell-fish ought to be protected rather more than they are under the present statute. We feel that if the scallop season were shortened and the scallops not allowed to be taken before the twentieth of September, that it would materially benefit not only the scallops but the citizens of the State, for the fact is, that during the three weeks from September 1 to 21, the scallops will grow and develop as much as in any previous two months, whereas, now the scallop season opens on the first of September and the scallopmen may be able to open two quarts of scallops to the bushel, we believe that if the closed season were extended that a bushel of scallops would open three quarts or better to the bushel. Therefore, it can be readily seen that not only are the scallopmen benefited, by getting more scallops for his day's work, but the people are benefited by getting just so much more food for a day's work. We would also recommend that the catch of scallops be reduced from what it now is, 25 bushels a day, to not more than 20, in fact, 15 bushels of scallops including shells would be a fair day's catch.

At the time when the scallop laws were enacted and the quantity to be taken was 25 bushels, a scallopman did not receive any more compensation for his day's catch than he will now receive from 15 bushel, at the price paid at this time, therefore, so far as the dollars and cents are concerned, he would be just as well off with 15 bushels under the present price.

Now to illustrate the advisability of prolonging the closed season; if a day's catch of scallops, being 25 bushels, produces 12½ gallons of scallops at $2.00 per gallon, equalling $25.00 and the catch of scallops at 15 bushels, opening 10½ gallons at $2.50 per gallon, equalling $26.25, you can see that the scallopmen are receiving a little more for their labor than under the present plan, and at the same time he would probably not have to work as many hours. We strongly recommend that the scallop law be amended by prolonging the closed season.

MUSSELS.

There is one shell-fish in Rhode Island which we have not hereto taken any interest in to any extent but which we particularly desire to call your attention, and that is, the mussels. In Europe mussels are an important article of food, second only to the oyster, and they are used to a considerable extent in some parts of the United States. It is simply a question of educating the people to the use of mussels as an article of food. The fact is, that none of the shell-fish are more nutritious and have more food value than the mussel, in fact, we have been informed by an expert that for its food value the mussel is superior to all other shell-fish.

The mussel, like the clam, has no protection in Rhode Island, in fact, for a great many years, mussels have been used only as bait by the fishermen and there has been no handicap on their being taken, and being destroyed, in fact, a few years ago some extensive mussel beds were destroyed by men who took out the mussels and carried them onto the shore and left them there to die, simply because these oystermen wanted the ground for oyster culture. This is a wanton waste of valuable food and we feel that some legislation should be enacted that will protect the mussel and allow a mussel industry to be developed. The U. S. Bureau of Fisheries has undertaken the development of mussel culture and has done considerable experimenting with the mussel as an article of food. During the last season, Dr. Irving A. Field of the U. S. Bureau of Fisheries has conducted an investigation in Rhode Island to ascertain the availability of Narragansett Bay for mussel culture, and he advises that there are about 1,200 acres of ground in Narragansett Bay that are capable of producing more than one million bushels of mussels per year, in fact, he has informed us that this bay is one of the finest fields for the growing of mussels that he has ever seen. We particularly desire to call your attention to the report of his work which follows. Inasmuch as we have been advised as to the condition of Narragansett Bay for mussel culture, we recommend that there be an act adopted by your Honorable Body allowing the Commissioners of Shell Fisheries authority to take up and encourage mussel culture.

A RECONNAISSANCE OF THE MUSSEL BEDS IN NARRAGANSETT BAY,

BY IRVING A. FIELD.

During the summer of 1917 the U. S. Bureau of Fisheries made a reconnaissance of the mussel beds on a limited portion of the north Atlantic Coast to determine whether or not this shell-fish, long neglected as a valuable food product, was sufficiently abundant to warrant the development of a mussel fishery. Narragansett Bay was the first region chosen for the survey because of its ideal location for supplying the needs of New England. The work here was done in close coöperation with the Shell-Fish Commission of Rhode Island which took a deep interest in the investigation and provided promptly every means for carrying it on. Particular credit is due Deputy Commissioner William B. Welden for making every effort to make the survey a success, even at the cost of personal sacrifice, and for in-valuable service rendered on account of his thorough knowledge of the bay. Without the coöperation of the Shell-Fish Commission and Captain Welden's assistance the degree of thoroughness with which the survey was done could not have been reached.

Before the establishment of the oyster industry in Narragansett Bay the region was one of the most prolific sources of first-class mussels on the Atlantic Coast. With the appropriation of bottoms for oyster culture more than 2,000 acres of mussel beds were destroyed to make room for the more valuable mollusk. Much of this wholesale destruction was wasteful and unnecessary although the parties responsible for it were unconscious of the fact. Only now that we are threatened with a food shortage are we beginning to realize that the sea mussel as a food product is a valuable asset to the nation and that, as in Europe, it should rank second only to the oyster as a fisheries product. Many oystermen are beginning now to realize that mussels, instead of being a handicap and a source of great loss in the conduct of their business, can be made a very profitable supplement to it.

The methods employed in making the reconnaissance were to dredge by means of an oyster boat over all the public grounds where mussels were likely to be found until a bed was located. Then a series of dredge hauls were made in different directions until the limits of the bed were found. Each point where mussels were taken was determined by means of ranges and marked on a large scale map. By connecting the outer points the limits of a bed were defined and from it the approximate area was determined. Note was also made of the age and condition of the shell-fish, the presence of dead shells and debris and the probable yield of each bed. No attempt was made to locate mussels on leased grounds. The condition, size and approximate yields of the mussel beds as developed by the reconnaissance are given below.

MOUNT HOPE BED.

South of Mount Hope a large bed of mussels in 31 to 54 feet of water extends almost the entire length of the middle of the bay inlet. The bed is roughly 9,000 feet long by 1,500 feet wide and covers about 275 acres. It is a very old bed which has been dredged over considerable. At the present time it is composed mostly of dead shells with a few large mussels 3½ to 4¼ inches long and a light set of seed mussels. The shell-fish were in fair condition for the month of July and will, in all probability, be of prime quality during the winter and spring. The yield, however, will be small and expensive to handle on account of the large numbers of dead shells. The available supply of culled mussels is about 500 bushels to the acre or a total of 137,500 on the entire Mount Hope Bed. The old mussels are fast dying out and unless the present young set of mussels survives, the bed will be practically extinct in another year. If the present light set of mussels survives the bed ought to be fairly productive again in about three years.

HOG ISLAND BEDS.

Two extensive beds of mussels lie south of Hog Island Light. The smaller of the two is on the west side of the channel in 15 to 20 feet of water and runs up close to the lighthouse. It has a length of 3,000 feet and a breadth of 500 feet which gives it an area of more than 30 acres. A ridge of 2½ to 3 inch, fat mussels extends the length of the middle of the bed while the outer portions contain old 3 to 3½ inch mussels with many dead shells. On first examination the prolific part of the bed only, chanced to be reached with the dredge and an estimate of 6,000 bushels per acre was made, but later observations on either side of the ridge proved this to be an erroneous assumption for the whole bed. A conservative estimate based on the data at hand would place the probable yield of this bed at 3,000 bushels per acre or a total of 90,000 bushels for the entire area.

The larger bed is on the west side of the channel and runs southwest towards Prudence Island Light for a distance of 10,500 feet and has an average breadth of a little more than 1,000 feet or an area of 235 acres. This bed like the Mount Hope Bed is old and in a dying condition but is not in such a depleted state. The northeast half of the bed contains an abundant supply of 3 to 3½ inch mussels in fair condition with patches of young mussels 1 to 3 inches in length. The marketable mussels culled out about one-half. This portion of the bed ought to yield close to 2,000 bushels per acre. The lower half of the bed contains old mussels 3 to 3½ inches long with a few young mussels 1½ inches long. They were in fair condition on July 10 and culled out less than one-half. The probable yield of the southwest half of the bed is 1,000 bushels per acre. This estimate allows an average yield of 1,500 bushels per acre or a total of 352,500 bushels for the entire bed.

DYER ISLAND BEDS.

Northwest of the northern point of Dyer Island about 1,000 feet and lying in from 40 to 60 feet of water there is a bed of mussels which covers an area 1,500 feet long by 500 feet wide. From this bed which is well known to mussel fishermen but two samples were taken to determine the character of the shell-fish. On both hauls the dredge came up full of old mussels 3 to 3¾ inches long in fine condition for the coming fall and winter market and ought to yield 3,000 bushels per acre or a total of 45,000 bushels.

Another larger bed of mussels lies just off the southeast point of Dyer Island in from 8 to 36 feet of water. It averages approximately 2,500 feet long by 1,000 feet wide and contains not less than 50 acres. It is an old bed made up of shell-fish from 3¼ to 4 inches long in fine condition with a few about 1½ inches long, and a light set of spat. There are many dead shells on the bed so that marketable size mussels will cull out a little less than one-half. The probable yield of the bed is 2,000 bushels per acre or a total of 100,000 bushels.

Hope Island Bed.

The Hope Island Bed lying 2,000 feet west of the south end of Hope Island in 20 to 36 feet of water is, at present, the best bed in Narragansett Bay. In size it is 5,500 feet long and averages 1,500 feet wide which gives a total area of not less than 135 acres. A fifteen acre piece of leased oyster grounds belonging to the Warren River Oyster Company is included in the bed. The bed is a young one, not more than four years old, composed of 3 to 3½ inch mussels with smooth, clean shells. They are in prime condition for the coming fall and winter market. This bed will probably yield not less than 4,000 bushels per acre or a total of 540,000 bushels. There are very few dead shells in the bed and the layer of mussels is so thick that a modern oyster boat equipped with two 8 bushel dredges could take on a load of 1,000 bushels in three hours time.

Dutch Island Bed.

This bed lies about 700 feet off the west shore of Dutch Island in 13 to 57 feet of water. Three years ago it was considered the finest bed in the bay and since then mussel bait fishermen have taken thousands of bushels from it. At present the bed is in a dying state and of little commercial value. It is covered with many dead shells and contains many depleted spots. In size the bed is more than 3,300 feet long with an average breadth of 1,300 feet. About 90 acres of the bed were definitely determined to which about 20 acres of almost depleted ground can be added on the northern end. The southern limits could not be explored on account of certain naval restrictions. In size the mussels are from 3 to 4¼ inches in length and they are in fair condition. The bed would be profitable to work if it were not covered with great numbers of dead shells. Dredge hauls culled out about one part of marketable mussels to eight parts of dead shells. On the east side of the bed west northwest of the light house there is a small area of 3 to 3½ inch mussels which will cull out better than one-half. The same is true of the northwest corner and of the southwest corner of the bed. When examined it was estimated that the bed would produce about 250 bushels per acre or a total of 22,500.

THE BONNETT BED.

The Bonnett Bed lies south of Dutch Island between Fox Hill and the Bonnett. The area covered is 4,600 feet long with an average width of 2,600 feet or about 270 acres. Great quantities of mussels have been removed from this bed during the past three years and it is now, for the most part, in a depleted and dying condition. The mussels are not evenly distributed over the area but lie in ridges and spots. The best portion of the bed is on the eastern side just west of Ragged Limb Ledge on a line between Dutch Island Light and Beaver Tail Light. This portion which includes between 20 and 25 acres is covered with a thick layer of fine mussels of the 3¼ inch size that cull out better than one-half. It will give an average yield of close to 2,000 bushels per acre. The rest of the bed is in a condition that admits of no reliable estimate as to the quantity of mussels present, but it probably contains not less than 500 bushels per acre on the average. The total yield of the bed at present is about 165,000 bushels.

SUMMARY OF NARRAGANSETT BAY BEDS.

The mussel beds of Narragansett Bay, as developed by the reconnaissance, lie in two distinct areas. The first is the region between Mount Hope Bay and Dyer Island on the east side of Narragansett Bay, while the second is the region between Hope Island and the Bonnett on the west side of the bay. Formerly this latter territory contained vast beds of mussels throughout its entire length, but in recent years most of the ground has been leased and cleaned up for oyster culture.

The total area of mussel beds located amounts to 1,100 acres with an estimated yield of 1,452,000 bushels. Most of the beds are old and no extensive new sets were found to insure a future supply of mussels from the natural beds. No private grounds were examined, however, and it is possible that an abundant supply of seed mussels may be found there for mussel spat was produced in abundance during the past season as indicated by the heavy sets on the stakes and buoys used to mark the oyster grounds.

Unless mussels should bring a much higher price than the command on the market at present, but little of this extensive territory could be worked with profit. With the high cost of labor that now prevails it is necessary to handle large volumes of the shell-fish in a short time. This cannot be done where great quantities of mud and dead shells are dredged up with the mussels. The cost of culling and washing under these circumstances renders any but a prime young bed unprofitable to handle at the present time.

The most profitable beds in the bay from which to take marketable mussels this coming season are the Hog Island Bed on the west side of the channel, the Dyer Island Bed at the northwest end of the island, the Hope Island Bed and that portion of the Bonnett Bed which lies west of Ragged Limb Ledge on a line between Dutch Island and Beaver Tail Light.

Food of the Sea Mussel.

The food of the mussel, as of oysters, clams and other mollusks, consists of diatoms which are minute vegetable organisms, protozoa which are microscopic animals, and detritus which consists of fine particles of decomposed sea weed and other vegetation. It has been fairly well established that these three classes of foods together with the dissolved mineral salts constitute the ultimate sources of marine food supply. They are practically inexhaustible and it is for this reason that the vast number of carnivorous animals in the ocean can exist where visible vegetation is practically absent. Big fish eat little fish which in turn eat smaller ones. The smaller fish eat crustaceans and mollusks which in their turn have fed upon the microscopic organisms and detritus. The microscopic organisms have the power in the presence of sunlight of combining air, water and the salts of the sea into food at a rate that is nothing short of phenomenal. As the late Professor W. K. Brooks has stated "Their vegetative power is wonderful, past all expression. Among land plants, corn, which yields seed a hundred fold in a single season, is the emblem of fertility, but it can be shown that a single marine plant very much smaller than a grain of mustard seed, would fill the whole ocean solid in less than a week if all its descendants were to live. This stupendous fact is almost incredible, but it is capable of rigorous demonstration, and it must be clearly grasped before we can understand the life of the ocean."

Besides the plankton organisms it has recently been pointed out, by certain Danish investigators, that decomposed eel grass and other vegetation in finely divided particles as detritus constitutes an important source of food for the bottom inhabiting animals such as oysters, clams and mussels. Between the plankton organisms and detritus, therefore, there is an inexhaustible ultimate food supply which can be quickly and readily converted into a form available for food consumption. It means that the bottoms available for the cultivation of oysters, clams, mussels and other shell-fish are far more fertile than we have ever dreamed in the past and explains why mussel beds, for example, are capable of producing an annual average of 2,000 bushels per acre.

The ocean properly cultivated, will yield far greater food returns with less expense of time and energy than will the land. Cultivation of shell-fish, and mussels in particular, offers the surest, most prolific and most economical method known for the production of flesh food. Appreciation of this fact is of great importance, especially at this time when it is imperative that every available source of food supply be conserved.

FOOD PRODUCTION IN NARRAGANSETT BAY.

As a source of shell-fish food, Narragansett Bay presents one of the richest areas for cultivation on the north Atlantic Coast. Protected from the entrance of heavy seas, shallow enough to permit cultivation in nearly all of its parts and to allow the water to be warmed quickly by the sun's rays, rich in its content of plankton organisms and detritus and with most of the bottom hard, sticky or muddy, it is an ideal region for the cultivation of oysters, clams and mussels. Practically every part of the bay is adapted for the growth of one or more kinds of these shell-fish, cultivation of which will yield far greater food returns with less expense of worry, time and energy than can be obtained from any of the agricultural products. As a source of food production and wealth, therefore, the bay is worth far more to the State of Rhode Island than an equal area of agricultural territory.

SUMMARY AND RECOMMENDATIONS.

1. Narragansett Bay is an exceptionally rich territory for the production of shell-fish.

2. The area of natural mussel beds alone was found to aggregate 1,100 acres with an estimated yield of 1,452,000 bushels.

3. More than 2,000 acres of mussel beds have been destroyed to make room for oysters, but hardly more than one-half of these grounds have actually been utilized.

4. In view of the fact that the food value of sea mussels is equal to that of any other shell-fish, it is recommended that steps be taken to prevent, hereafter, the unnecessary and wasteful destruction of the mussel beds in Narragansett Bay, and that wide publicity be given to the qualities of the mussel as a food product by means of special articles in newspapers and magazines, lectures and demonstrations in churches, schools and Y. M. C. A. buildings and by coöperating with proprietors of markets, hotels and restaurants, in bringing them prominently before the public. It is believed that such a campaign of education if properly conducted will result in building up a new and profitable industry in the State of Rhode Island and add considerably to the food resources of the nation.

STARFISH.

We have repeatedly called your attention to the destructiveness of the starfish, and we feel obliged to again call your attention to this menace to the fisheries of Rhode Island. In the report made by us to you at the January Session in 1915, we called your attention to this menace at considerable length, in fact, we gave you a synopsis of the natural history of the star as set forth in a paper prepared by Dr. A. D. Meade of Brown University, published in a report made to the Commissioners of Inland Fisheries. We particularly called your attention to methods that Dr. Meade recommended as being advisable toward exterminating this pest. We went before your Honorable Body and asked for an appropriation to assist in eliminating this menace to the fisheries. At the time when we went before your committee, we stated that unless there was something done to relieve the situation, you would lose much more in revenue than what we are asking, and this has fully come to pass.

We have repeatedly called your attention to the fact that not only do the stars destroy enormous quantities of oysters but they also destroy enormous quantities of clams and other shell-fish. This particularly takes place when the shell-fish is small, because of that fact, that they gather in large quantities in seaweed for protection and the starfish also gather in large quantities in seaweed for protection and the stars usually spawn earlier in the season, and therefore are large enough to consume enormous quantities of these shell-fish when they gather in the seaweed. In order to illustrate the enormous quantity of clams that a single star will consume, we quote an experiment conducted by Dr. Meede, which was as follows :

"In order to ascertain how fast the stars of the average size found upon eelgrass would devour the young clams of average size, I placed one such star in a dish with fifty-six clams taken at random from the margin of a stone. The larger clams were about the length of one arm of the star, and they ranged from this length to one or two millimeters. The experiments were begun at 1:20 P. M., on July 18; at 5:40 P. M., two clams had been devoured, each about the length of the arm of the star, and during the evening a third was eaten. At

8 o'clock the following morning five had been eaten; at 9 o'clock, six; and at 9:15, the seventh clam had been attacked. I was absent from the laboratory for the next four days, and returning on the 22d found, at 6 P. M., twenty-nine empty shells whose contents had been eaten by the starfish. The starfish had grown considerably, and was eating faster than formerly, for on the next day thirty-nine empty shells were found, and on the day following this forty-six were empty, while ten more had disappeared altogether, having doubtless been devoured shell and all at some time during the week. To make sure that the clams were killed by the stars, and did not die from some other cause, a control dish of clams was kept, in which all the specimens lived. In six days the one starfish devoured over fifty clams."

We believe that not only should the starfish be eliminated from Narragansett Bay, but that they should be utilized as fertilizer for the farmers, and we firmly believe that it is a mistake on the part of the State of Rhode Island to allow as valuable fertilizer as these stars have proven to be, to go to waste and not only waste but to destroy one of your leading industries. Not only as a destroyer of the industry do we call your attention to them, but the enormous quantity of food that is being destroyed by this nuisance. We feel strongly that it is wrong not to endeavor to utilize these stars.

The analysis of starfish as a fertilizer, we quote from a report made by the Agricultural Experiment Station in 1897. This analysis and report on starfish was made by George W. Field and was as follows :

"In order to get the actual commercial value of starfish as a practical fertilizer, a careful chemical analysis has been made by the Chemical Division of the Experiment Station.

The first column of figures = Calculated to live unrinsed fishes as received. The second Column of figures = Calculated to absolutely dry starfishes rinsed with fresh water before drying:

	Per Cent.	Per Cent.
Loss by rinsing with fresh water and complete drying	65.43	.....
Crude ash	20.34	58.84
Lime (calcium oxid)	9.62	27.82
Potash (potassium oxid)	.23	.66
Phosphoric acid (P_2O_5)	.20	.57
Nitrogen	1.80	5.20
Insoluble matter	.34	.97

The quantities of soda, magnesia and certain other ingredients were not determined.

Estimating the lime at .421 of a cent, potash at 4¼ cents, phosphoric acid at 5 cents and nitrogen at 13 cents per pound, which are the approximate retail prices in Providence, the starfish, as taken from the water have a value of 29½ cents per 100 pounds, and, after rinsing and complete drying, a value of 85 cents per 100 pounds.

It is intended to carry on at the State Agricultural Experiment Station definite experiments to determine actual manurial value of starfish for various crops, both alone (whole, dried and pulverized) and where mixed with other chemical plant foods.

In regard to the practical question as to the advisability of placing a bounty on starfish; it would seem as if the demonstration of the fact that starfish are worth for fertilizing purposes .27½ cents per 100 pounds, delivered on the wharf, should be incentive enough to the fishermen, especially when taken in connection with the fact that every starfish destroyed is of direct benefit to those dependent upon the shell fisheries; still, if for special reasons it should seem fitting to place such bounty, the bases should be, for convenience, per hundred weight rather than per bushel."

Dr. Field in this report, estimates that the actual amount, according to his analysis, and his estimate is a very conservative one, there are 1,000 tons, whose value is at least $5.00 per ton. Now if the estimate of Dr. Field in 1897 was a conservative estimate, undoubtedly there will be ten times as many stars in Narragansett Bay today as there was in 1897, and it would seem to us that if the value, as fertilizer, is equal to what was stated in his report, that it would be the part of good judgment upon the State of Rhode Island to utilize these stars and convert them into fertilizer.

We strongly recommend that there be a fertilizing plant established under the supervision of the Board of Agriculture, and allow these stars and other debris taken from the waters of the bay to be converted into fertilizer.

New Ground.

During the year 1917, the ground leased has been a trifle less than preceding years, being 30.2 acres at ten dollars per acre, and 96.8 acres at five dollars per acre, making a total of 127.0 acres.

Ground Cancelled.

We are sorry to announce that the ground cancelled during the year 1917 was greater than any previous year in the history of the industry. The cancelled ground being 889.6 acres at $10.00 per acre, and 3,136.9 at $5.00 per acre, making a total of 4,026.5 acres.

We have previously, in this report, called your attention to the decrease of the oyster industry and we again desire to call your attention to the fact, that the oystermen have been, and are now conducting a business under exceedingly great disadvantages, and first, they have not been able to obtain oyster sets for four or five years to any extent and what little sets were obtained by any of them, have been almost invariably destroyed by the stars. Also the grounds that formerly were valuable for the purpose of growing and fattening oysters have been deteriorating to such an extent that some of them have been cancelled, as the ground is practically worthless. It is a fact that oyster ground that five years ago produced oysters that opened one gallon to the bushel of selects, today produces about two quarts to the bushel of not very good mediums and some of the beds will not produce even a medium oyster under five or six years of age, where formerly a four-year-old oyster was considered as being fully matured.

A few years ago the oystermen came down from Connecticut and took out ground here because of the fact that the oysters growing in Long Island Sound are found to be green in color, and upon their being planted here this color was eliminated and the oysters fattened and flavored. The fact is that today green oysters are found growing in Rhode Island, and this is a new experience in the oyster business.

We are exceedingly sorry to have to say that the outlook for the oyster industry in Rhode Island is not at all good and that unless some means are devised whereby we can change the conditions that now confront the oyster business, it will be considerably reduced from what it now is.

The cancellations during the year 1917 have decreased the revenue to the State about $24,610. The decrease in the oyster industry in Rhode Island since January 1, 1913, being a period of five years, has been 10,463.7 acres or 45.32%. During the same period of time there has been eliminated from the oyster business thirty-one people and firms, that is thirty-one who held oyster ground on January 1, 1913, have ceased to hold any ground whatever, and have gone out of business. Of those who have continued in business, sixteen were taken promiscuously from the records with the only point in view of selecting those who are experienced oystermen and not handicapped for the want of capital to conduct a business. Also we call your attention to the fact that during the season of the fall of 1912, and the winter of 1913, the average daily output of shucked oysters from Rhode Island was about 8,000 gallons, while at the present time the daily output from Rhode Island is less than 2,000 gallons. Therefore you can see that not only is the State losing revenue and the oystermen losing business, but the people are losing enormous quantities of food stuffs, and that is of such great importance at a time like this when the entire country is conserving every resource that may be utilized for the production of food, that we feel that some means should be adopted whereby as much assistance as possible should be rendered.

Leased Ground.

The number of acres of ground that are under lease, as recorded in the book of the Commissioners of Shell Fisheries, on December 31, 1917, is as follows: 4,364.9 acres at $10.00 dollars per acre, 6,104.9 at $5.00 dollars per acre, and 240.0 at $1.00 dollar per acre, making a total of 10,709.8 acres. Total annual rental amounts to $74,413.50.

Financial Statement of the Oyster Industry from January 1, 1917, to December 31, 1917.

RECEIPTS.

Received from rent of oyster ground	$91,936 78
Received from interest	700 54
Received from 1914 tax	81
Received from fishermen's licenses	484 00
Received from scallop licenses	245 00
	$93,367 13

DISBURSEMENTS ALLOWED BY COMMISSIONERS OF SHELL FISHERIES.

Salaries Provided for by Provision of the Law.

Salaries of Commissioners	$2,500 00
Salary of Clerk	1,800 00
For Clerical Assistance	600 00
	$4,900 00

Appropriation allowed for expenses of department		$12,000 00
Salaries of deputies and inspection of stakes and buoys	$4,935 69	
Engineering and surveying	1,583 33	
Stenographer	638 50	
Sanitary work	349 25	
Laboratory supplies and expenses	97 66	
Inspection of oyster houses	500 00	
Licensed fishermen's boat numbers	31 50	
Advertising cancellation of oyster ground	92 15	
Printing	56 00	
Traveling expenses of committees	205 08	
Machine for testing oyster ground	29 18	
Postage	97 50	
Office supplies	126 96	
1917 maps	83 49	
Repairs to typewriter	8 00	
Toll calls	7 35	
Repairs to boat	295 98	
Supplies for boats	331 02	
Extra work on boat	66 41	
Planting oyster shells on public ground	1,867 64	
John L. Leon, sealing measures	2 56	
	$11,405 23	
Unexpended balance	594 77	
		$12,000 00

Receipts for the year 1917		$93,367 13
Salaries provided by law	$4,900 00	
Expenses of department	11,405 23	
Total expenses		$16,305 23
Net revenue		$77,061 90